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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/506,854	09/02/2004	Michael Bock	BOS0067	4503

7590 03/05/2007

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EXAMINER	
PILKINGTON, JAMES	
ART UNIT	**PAPER NUMBER**
3682	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/05/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/506,854	BOCK ET AL.	
	Examiner	Art Unit	
	James Pilkington	3682	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06 February 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-14* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-14* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date 12/07/06
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-11 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murakami et al, USP 6,550,567, in view of Alexander Kapelevich's article "Geometry and design of involute spur gears with asymmetric teeth" (Published in "Mechanism and Machine Theory" Volume 35, Issue 1, January 2000, pgs 117-130).

Murakami discloses a worm gear for a vehicle steering system comprising:

- A shaft (attached to worm gear 71) swivably mounted for swiveling in the radial direction (in the direction of Y)
- A worm (71) disposed in a rotationally fixed manner on said shaft (71 is part of shaft)
- A worm wheel (72) preloaded in the radial direction (meshing with teeth of worm causes some preloading)
- A housing (8)
- A fixed bearing (11)
- A loose bearing (10, moves inside and relative to 22 via elastic members 20)

- A slot (81)
- A support ring (22), said loose bearing (10) bears against said housing (8) via said support ring (22, 20 connects the bearing to the ring, the ring connects to the housing)
- A spring element/anti-twist device (20, elastic member) disposed between the loose bearing and the housing (via the support ring 22). It is to noted that the spring and anti-twist device are the same device as disclosed by the applicant on pg 8 ln 14 of the specification submitted on 11/4/04.
- The spring element is a plate spring (Fig. 8 shows the elastic member 20 as a plate spring), or a leaf spring (Fig. 5 shows the elastic member 20 as a leaf spring connected to the housing via the support ring)
- A motor (6)
- The worm (71) is cantilevered on the shaft (see Fig. 4)
- The shaft is mounted in the housing (8) by means of rolling bearings (fixed bearing 11)

Murakami does not disclose that the worm wheel has teeth that have different pressure angles on the left and the right so that the normal force between said worm and said worm wheel is independent of the direction of rotation of a torque exerted on said worm by said worm wheel.

Kapelevich teaches a gear that has teeth that have different pressure angles on the left and right (also known as asymmetric gear teeth, see Figure 4 of Kapelevich, Φ_{rc} and Φ_{rd}) so that the normal force between said worm and said worm wheel is

independent of the direction of rotation of a torque exerted on said worm by said worm wheel for the purpose of providing an increase in load capacity while reducing weight and dimensions of the gear (pg 13, Conclusions).

It would have been obvious to one having ordinary skill in the art at the time of the invention to modify the teachings of Murakami and provide a gear that has teeth that have different pressure angles on the left and right so that the normal force between said worm and said worm wheel is independent of the direction of rotation of a torque exerted on said worm by said worm wheel, as taught by Kapelevich for the purpose of providing an increase in load capacity while reducing weight and dimensions of the gear.

3. Claims 12 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murakami et al, USP 6,550,567, in view of Alexander Kapelevich's article "Geometry and design of involute spur gears with asymmetric teeth" (Published in "Mechanism and Machine Theory" Volume 35, Issue 1, January 2000, pgs 117-130) and further in view of Lu et al, USP 6,046,560.

Murakami in view of Kapelevich discloses all of the claimed subject matter as applied to clms 1-11 above and Murakami also discloses that the motor (6) has an output shaft (12).

Murakami in view of Kapelevich does not disclose that the motor has three-phases and FET's are used to short-circuit at least two phases.

Lu teaches that a motor has three phases (Aa, Bb and Dd) and FET's (switches) are used to short-circuit the phase (turn the phases on and off C9/L39-C10/L12) for the purpose providing a motor that has the capability of adjusting current through the phase to assist in the steering of a vehicle (C10/L11-12).

It would have been obvious to one having ordinary skill in the art at the time of the invention to modify the teachings of Murakami in view of Kapelevich and provide a motor has three phases and FET's are used to short-circuit the phase, as taught by Lu, for the purpose providing a motor that has the capability of adjusting current through the phase to assist in the steering of a vehicle.

Double Patenting

4. Claims 1-11 and 14 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-20 of U.S. Patent No. 6,860,829 in view of Alexander Kapelevich's article "Geometry and design of involute spur gears with asymmetric teeth" (Published in "Mechanism and Machine Theory" Volume 35, Issue 1, January 2000, pgs 117-130). Claims 1-11 and 14 of USP 6,860,829 discloses a worm gear for a vehicle steering system which comprises a shaft, a worm, a worm wheel, a housing, a fixed bearing, a loose (moveable) bearing, a support ring, and a spring element. Claims 1-11 and 14 do not disclose that the worm wheel has teeth, each said tooth having right and left tooth flanks which are inclined at respective pressure angles that are different between the left and right flanks (also known as asymmetric gear teeth, see Figure 4 of Kapelevich, Φ_{rc} and Φ_{rd}). In view of the teachings of Kapelevich it would have been obvious to one having ordinary skill in the

art to modify claims 1-11 and 14 of USP 6,860,829 and make the gear teeth asymmetric, as taught by Kapelevich, for the purpose of providing an increase in load capacity while reducing weight and dimensions of the gear (pg 13, Conclusions).

Response to Arguments

5. Applicant's arguments filed 2/06/07 have been fully considered but they are not persuasive.

6. In response to applicant's argument that Kapelevich is nonanalogous art, it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, in this case the Kapelevich is reasonably pertinent to the particular problem of providing gear teeth with different pressure angles between the left and right flanks. Furthermore, the applicant argues that Kapelevich is nonanalogous as it relates to a spur gear not a worm gear but the claim does not state that the worm gear has the different pressure angles. The claim reads "...said worm wheel having teeth, each said tooth having right and left tooth flanks..." (lines 4-5). As a worm wheel is nothing more then a spur gear with either angled or helical teeth Kapelevich is an analogous piece of prior art.

7. Applicant further argues on page 8 lines 11-15 that Kapelevich fails to teach a "technique for selecting different angles so that the normal force between said worm

and said worm wheel is independent of the direction of rotation of a torque exerted on said worm by said worm wheel."

The examiner agrees that Kapelevich fails to teach a technique for selecting the different angles. However, the claims are not claiming a method of selecting the proper angles of the gear teeth. The claims are directed toward an apparatus which has teeth having different pressure angles, which Kapelevich teaches. The use of different pressure angles results in a device that has a normal force between the gears that is independent of the direction of rotation of a torque exerted on one gear by the other.

8. In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, Kapelevich does indeed provide motivation as stated in the rejection above. The motivation provided by Kapelevich is that the asymmetric tooth side surfaces enables for an increase in load capacity and durability.

9. In response to the applicant's traversal of the double patenting rejection, it is the examiner's position that this rejection is proper for the same reasons as stated above in sections 6, 7 and 8 of this office action.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to James Pilkington whose telephone number is (571) 272-5052. The examiner can normally be reached on Monday-Friday 8:00AM-4:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Ridley can be reached on (571) 272-6917. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JP
3/1/07

RICHARD RIDLEY
SUPERVISORY PATENT EXAMINER